+TV4E: AN INTERACTIVE TELEVISION PLATFORM AS A SUPPORT TO BROADCAST INFORMATION ABOUT SOCIAL SERVICES

Hilma Caravau
Digimedia (CIC.Digital)
DECA, University of Aveiro
3810-193, Aveiro, Portugal
(+351) 234 370 389
hilmacaravau@ua.pt

Telmo Silva
Digimedia (CIC.Digital)
DECA, University of Aveiro
3810-193, Aveiro, Portugal
(+351) 234 370 389
tsilva@ua.pt

ABSTRACT

In the last decades almost all countries face the increasing of elderly population [1]. Given these recent changes, there have been appearing a several number of gerontechnologies to enhance seniors' quality of life. In this context and despite the strong investment from the Governments to disseminate services like distance help or provision of medical information, the level of success is still very low. Possibly this failure is due to the fact that most of these approaches requires the user to search for the information (a "pull-oriented" activity from the user's perspective) rather than a "push-oriented" where the user receives the information. Television (TV) is one of the privileged resources to reach the general population, but it is an even more powerful way to achieve older people, limited to their home or in institutional context, due to the fact that almost all seniors are familiar with a TV set.

Elderly are commonly in a disadvantaged position, for not knowing how to access public and social services they can benefit from (e.g. medication discounts, medical appointments, etc.). Regarding this, it is being developed an iTV platform (+TV4E) which aims to disseminate information about public and social services for seniors, by interrupting the visualization of linear TV content with audio-visual content about these services.

In order to broadcast the information that elderly viewer most need and want to receive, it will defined a set of user profiles. The profiles' definition will be achieved throughout a set of selection phases, and the first phase involves the definition of the individuals that will be able to interact with the +TV4E. In this paper is presented a set of criteria for the first filtration of users who can benefit from this type of iTV services and the respective services that they can be interested in receive information about.

Keywords

iTV, Seniors, Public Services, Social Services.

1. INTRODUCTION

Currently almost all countries face the increasing of elderly population, which represents a major challenge for individuals, societies and governments. The increase in average of life expectancy is a result of improvements in living conditions, especially in terms of health, education, housing, social participation. Although ageing is characterized by several physical, psychological and social changes that can result in numerous problems, being old does not necessarily have to be synonymous of illness, disability, dependency, isolation and loneliness. Previously the limitations that emerged could be hindering the successful aging, but in recent years were developed technologies that can fulfil the needs of older people and their caregivers, namely called "gerontechnologies".

Many of these technologies are designed to increase the sense of belonging to communities, increase the social network and also the levels of welfare and literacy. At this level, television is a technology of high importance and great potential, being one of the preferred media for accessing information and entertainment. Given the proximity and familiarity that elderly have with television sets, the development of interactive television platforms are a promising way to access information that otherwise would not be accessible. The demand for information and services through interactive television platforms (iTV) is a reality, but there still a low level of advantages of these services for older users. Concerning information seek activities, eventually the fact that this is a "pulloriented" activity (implies the demand for information by the user) instead of "pushoriented" (the information is presented without the search) is the determinant factor of the low utilization of these platforms.

In this context the audience of the +TV4E project, is the Portuguese elderly considering their characteristics, needs and expectations in the use of public social services such as finance, social security and social support services. Thus, the aim is to develop an application for interactive television (iTV) that can enrich, automatically, the television experience with the integration of information of public and social services considering user profile. The application will be designed in a user-centered design approach, with the integration of assistive technologies and multimedia communication multichannel approach. In order to illustrate the central idea, imagine the scenario in which the income tax system changes (for example, people over 66 years become eligible for a discount through the delivery of a statement). This information can be sent to seniors while they watch TV in the following way: a) on the TV content, in a graphical overlay, a warning appears stating that an informative content will shortly be presented; b) if the user does not cancel this content presentation, namely, if the user does not press a remote control key targeted to cancel the information content, it will appear replacing the television content for a few moments.

The user experience associated of technological solutions relies in several aspects. To make the use of platforms a pleasant, personalized and an added value experience for elderly viewers it was verified that "user profiles" is a key feature. These profiles aims to reflect the interest of users in specific subjects, at a specific moment. The moment associated with the profiles is quite important because as time goes by users can modify their interests due, for example, to the appearance of a specific disease.

2. THEORETICAL FRAMEWORK

The ageing population is one of the greatest achievements of humanity, but is also one of the great challenges of modern societies. This fact is affecting most countries around the world quickly, as a result of increased life expectancy and lower fertility rates.

In recent decades it is possible to observe the marked reduction of avoidable mortality and the increase in average of life expectancy mainly due to the improvement of living conditions, such as access to better food and nutrients, water and enhancements in sanitation and health systems through prevention and control of parasitic and infectious diseases [2].

There is no universal criteria in respect the chronological age in which it is considered that a person enters in the old age. Some organizations such as United Nations and the World Health Organization considers elderly the individuals with 60 or more years [3,4]. In Portugal, as in most developed countries, are considered elderly the men and women aged over 65 years, being this age associated with the transition to the pensioner situation [5,4]. In 2014 the Portuguese government decided to change the age of retirement for 66 years and 2 months, taking into account the effects of changes in life expectancy at 65 years recorded between 2013 and 2014 [6]. This rule is effective since the beginning of 2016.

In 2012, the world population reaches 7 billion people, of which about 8.0% (562 million) were 65 or more years. In 2015, this proportion rose to 8.5% of the total population [2]. These changes have resulted in a significant reversal of the age pyramid in societies, and Portugal did not escape to this reality. Between 2001 and 2011 the percentage of Portuguese elderly increased from 16 to 19% [7]. Population ageing index was 102 in the year of 2001, reaching 128 in 2011, which means that for each 100 young people there were 128 elderly people [7]. In 2012 there were 2,032.606 people with 65 or more years living in Portugal. Projections indicate, given the high scenario (combines the optimistic possibilities of evolution regarding fertility, mortality and migration), that in 2060 this number will increase to 3.343,987 [8].

Over time, a set of transformations occurs in all human beings at biological, psychological and social level [9, 10], leading to the emergence of a new group of challenges, as is chronic disease and disability, the need to stimulate further independent living of older people, combat the social isolation, among others [2].

Although it is not mandatory, ageing is often characterized by economic vulnerability due to reforms and low pensions, poor housing, high costs with health care, and by social changes resulting from modifications in the social network (as a result of retirement, change in network of friends, the death of the spouse, family disintegration due to family and work requirements) and difficulty in interacting and communicating with younger generations [11,12].

In line with this and in order to respond to demographic changes and to the issues that ageing raises, the World Health Organization adopted the concept of "active ageing" and defined it as the process of optimizing opportunities for health, participation and safety in order to improve the quality of life of the elderly [13]. This concept should guide the development of societies to support older people to remain active in the labour market, and ageing integrated in society. However, ageing is often associated with restrictions accessing public services to individuals and their families.

Although many older people continue to live actively, healthy and in a participatory manner after retirement, others face a number of problems such as poverty/financial difficulties, illness or disability, loneliness and social isolation that can limit or restrict their lifestyles [14]. Most people prefer to continue living at their homes, rather than going into residential institutions, due to connection to memories, experiences and objects.

In many cases the elderly are isolated from the rest of society, being in very vulnerable situations. In 2016, in the Portuguese territory were identified 26,000 elderly people as living alone (60%) 4,626 isolated and 3,085 living alone and isolated (7%) [15].

The European authorities believe that Information and Communication Technologies (ICT) is one of the possible answers with great potential to support older people to improve their quality of life, stay healthy, keep autonomous, live longer in their own homes ("natural environment") and help to transform care in response to the needs of patients [16,14,17].

This point is evident by the increase in the number of innovative devices developed by several companies and individuals to elderly, commonly known as "gerontechnologies".

Although there is a generalized stereotype that older people are resistant to the use of ICT, is becoming increasingly know that this population group is more receptive and interested in the use of new technologies [18]. The use of assistive technologies presents a number of benefits for the elderly like access to information and increasing the degree of independence.

In last decades, television was one of the great discoveries and agent of change in societies. This is one of the audio-visual media preferred by the population, and in Portugal it reaches the podium in the list of preferences of individuals [19,20].

Despite not being a gerontechnology per si, television has an interesting potential regarding support for elderly population, especially on health field. The interest of the elderly by health appears to be consensual, considering that this is one of the areas where more information needs is felt [21,22]. In this context, and despite the pressure and the efforts that governments have developed to disseminate medical support services remotely or providing medical information, success levels remain very low.

Normally the access to information implies that there is a pro-active behaviour by the user, which means, that is necessary that they, for example, conduct a search through the internet, so, this activity is totally dependent on the ability of demand. Therefore, it is believed that the lack of adherence to the services available for the elderly may be related to this fact, which means, services will be provided in a logic of "pulloriented" in the point of view of the user (there is a need to be the user to search for information) rather than being developed strategies "pushoriented" where the user receives the information without having to make any effort.

Nowadays television is often the only company of elderly in their homes, or even in institutional context [23].

From the 9 leisure activities analysed by Martins (2010) in their study, watching TV was the second activity that take more time to elderly, and was the predominant activity in the group of institutionalized people [23]. In 2010, the average daily consumption of television was 3 hours and 29 minutes per each

Portuguese viewer [24]. When these data are analysed disaggregated by age group, people with more than 64 years watch an average of 5 hours and 8 minutes a day [24].

Interactivity functions enhance TV with functionalities that have a great potential for older people to get relevant information for their daily living activities. In theory, sending information through a familiar device and with great level of use, makes interactive television (iTV) the ideal transmitter for this purpose.

There are already several solutions for elderly people supported in iTV platforms, especially in health (e.g. cognitive and physical stimulation), security and promotion of independent living.

The "SmartSenior" project designed and implemented intelligent services for older people that were integrated into the TV system at home in order to support the daily life of their target group [25]. More focused on the health field, the eCAALYX project was supported in a TVbased interface so patients can keep track of their health. The solution also promotes the interaction between seniors and caregivers networks [26]. Also in health, but focused on dementia, the CogKnow project has the ambition to help the elderly with dementia through prototypes that include audio messages and visual reminders and guidance on TV [26]. This project had a huge impact in the quality of life and promote the independence of people with dementia. The iStoppFalls project aims to predict and prevent falls by monitoring mobility-related activities and other risk factors of falls in real life and is completed by an innovative iTV application [27]. In this framework is worth to refer the “iNeighbour TV” project where it was developed and tested in a field trial, an iTV application to trigger medication reminders; to enable social interaction over the iTV application; and to access information regarding services such as pharmacies, weather and community events [28].

Taking the previous facts into account and the potential that television has to improve the quality of life of older people and considering the requirements that seem to exist in access to public and social information, the project +TV4E comes with the aim to address these needs. After the definition of services that will be provided by the +TV4E platform, it will be briefly explained how the project is intended to work.

3. +TV4E: INTERACTIVE TELEVISION AS A SUPPORT TO INFORMATION BROADCAST ABOUT SOCIAL SERVICES FOR SENIORS

The project +TV4E: Interactive Television as a support to information broadcast about social services for seniors suggests a method to the delivery of information through a familiar terminal like the TV set, in a personalized way to seniors. The target audience of this project is the Portuguese senior population and it consider their specific issues, needs and expectations in the use of public services, like the public social security and tax office, in order to develop an interactive television (iTV) platform which allows automatically the enrichment of television experience with the integration of contents about public and social services.

The iTV application will run on set-top-boxes and will be designed to interpolate informative contents (about public and social services) with the linear television content. These informative contents will consist of a combination of several types and formats (sound, video and text). Thus, in practice, the senior will receive a warning stating that the informative content will be interpolated with the regular TV contents. The information to the seniors will be delivered according their profiles. If a senior is not interested in receive information about taxes, the platform will not deliver to him this type of information.

4. METHODOLOGY

Older people have several aspects that distinguish them and a history of life full of experiences that define them as a highly heterogeneous population, with many peculiarities. These particularities must be taken into account when defining a platform that will be in the environment of elderly and can be an essential point in maintaining or improving their quality of life. Considering these characteristics arises the need to set the user profile. The definition of user's profiles involves a series of steps along the construction process, which will be carried out during +TV4E project. This definition will be an ongoing process which will result from several interactions with potential end-users, experts and researchers in the field, namely through interviews and focus groups.

However, in the initial phase of the process it is necessary to define a set of criteria that will "filter" the type of users who will be interested in access to social and public information through an interactive television application. Thus, this paper aims to present a proposal for the development of the initial stage of the user’s profile for the iTV platform +TV4E that include the definition of inclusion criteria of target population of the application.

To put forward variables for the first stage of user’s profile definition, a first analysis of literature review in the field of senior’ population characteristics, iTV and user’s profiles was made by the project team.

Considering the lack of studies only focused on the definition of user's profiles taking into account the information that individuals would like to receive via interactive television platforms, there was the need to construct a list of criteria considering the experience and knowledge of three experts invited by project team.

The process was iterative and conducted in parallel by three experts, in order to build three independent lists of criteria that were afterwards compared and discussed before compilation. The resulting list of criteria was after discussed with all the members of +TV4E project that include researchers with experience in fields of iTV and seniors.

5. INITIAL STAGE OF USER’S PROFILES DEFINITION

The aging process is transversal to all living beings, however, the experiences are lived differently among individuals and are dependent on genetic and environmental factors [29]. The experiences of each person, turns every individual in a unique human being with their own identity, needs and expectations. Usually the services and products are defined as standard for the entire population, or possibly take into account high-level issues such as the age groups and gender. When it comes to new technologies for the elderly, some studies have reported the existence of the widespread stereotype that older people are not receptive to the use of new technologies, defining this concept as *techno-ageism* [30]. This stereotype is questioned by a number of studies, however, it is a fact that many seniors feel little confident in their abilities to use technologies and feel anxious when using them [30,31]. Also, if seniors does not felt that a specific technology is useful they will easily stop using it. Another important factor to motivate seniors to use technologies is the user

experience that they perceive. In order to make the use of iTV platforms a pleasant, productive, an added value for life and with the most personalized experience as possible, it was verified the need to create user's profiles. The purpose of user profiles is to reflect the interest of users in specific subject, at a specific moment [32]. There are different approaches to construct the user profile, i.e., there are systems that build automatically the profile performing content-based filtering, while others require the direct action of the user that defines his/her interests [32].

In this study, the user's profiles will be build considering a set of information about the users regarding the information of services that they prefer to receive through the platform +TV4E. The defined profiles will enable the adaptation of content to be displayed during the broadcast of television programming and satisfy objectively and effectively the needs of the elderly, keeping their interest in the service and improving their access to information.

The task of defining user's profiles is a sensitive issue and an ongoing process that involves several steps. This is a crucial phase of the project that can define its success and receptivity. Thus it is essential to accomplish the collection of information with potential users, researchers and people with experience in the field through techniques as interviews and focus groups.

Before these tasks, it was developed a list of criteria considered important for a first filtering of potential users to include in +TV4E, which is considered the first stage in the user's profile construction to apply in the resulting interactive television application.

The first criterion to the user's profile definition is the age and it is considered that participants should have more than 60 years. It was defined this range, considering that there is an increase in television consumption by people over 55 years. In Portugal, after the age of 25 there is a gradual intensification in the number of hours spent in front of the TV [24,19]. On average, there is an increase about 1 more hour of television consumption when passing the age of 45-54 years for 55-64 years old [24].

The interaction with the platform will require, at different stages of the process, that the user read informative content. In order to operate with the application, it is mandatory that the person **know how to read**. The question regarding the education level will give enough information about this competence.

The parameter **digital literacy** is closely linked to cognitive abilities, professional experience and experience and appetence for technology. Despite the technology market has an increasing degree of adequacy of its services in terms of quality of applications, terminal equipment, the communication infrastructure and usability and user experience (where it is intended to minimize the users' efforts) [33], is a facilitator element the user already have some digital knowledge. Digital literacy is an essential skill in modern times since it allows access to a range of social and economic opportunities [34] that improve, unmistakably, the services access and consequently the quality of life.

To measure the digital literacy of individuals will be used the Eurostat questionnaire "Community Survey on ICT usage in Households and by Individuals" where it is considered that digital literacy is related to the use of personal computers and Internet [34]. This survey is composed by 12 items, as for example, if the individual is able to copy or move a file or directory. Those who can perform five or more tasks are classed as high skilled, if it fulfils three or four tasks have media digital literacy, with one or two completed items has low digital literacy and is classified as having no digital skills if they do not perform any task [34]. In order to reduce the number of variables, and possible values for it and the consequent number of different profiles, to define the initial stage of the user's profile, authors decided to make an adaptation of the results, and will only be considered two levels to score the digital literacy. So, if the individual can perform at least one task successfully is considered having digital literacy, if they not accomplish any task it is classified as having no digital literacy and will be excluded from the study.

Associated with the aging process, many times, tend to appear some changes at the cognitive level. Some of these events are "normal" cognitive disorders linked to the ageing, but it can be a pathogenic modification [29]. The working memory, speed of thought and visuospatial skills tend to suffer a decline with age, but verbal intelligence, attention, calculation ability and most language skills remain unchanged [29]. Regarding this, as the last criterion it is essential to evaluate the **cognitive impairment** of individuals to ensure that cognitive changes did not bias the study. This criterion will be evaluated through the application of the version adapted to the Portuguese population of Mini-Mental State Examination (MMSE) [35]. The test consists of 30 questions that assess six cognitive domains, including orientation, registration, attention and calculation, recall, language and construction. The score ranges between 0 and 30 points, with higher scores indicating better cognitive performance, and in Portugal the cut-off scores are defined according the literacy groups (15 points in illiterate individuals; 22 for 1-11 years; 27 to > 11 years) [36]. If the results of the MMSE suggests cognitive decline, the subject will be excluded from the sample. Figure 1depicts the idea of the criteria considered.

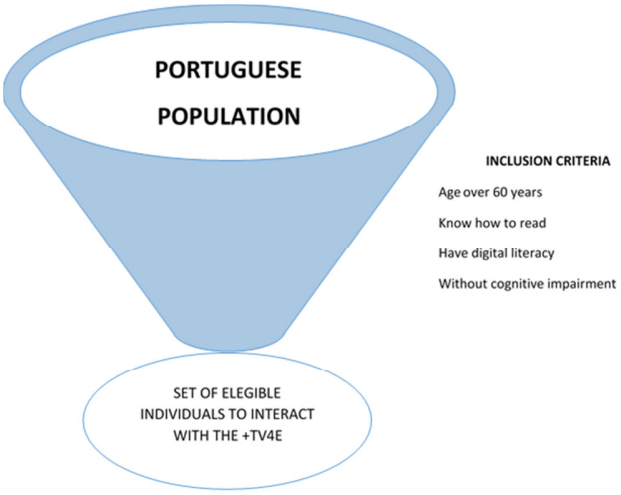

Figure 1. Summarization of the inclusion criteria.

It was noticed during the first phase of user's profiles definition that, considering the diversity introduced by the ageing process, there is a wide range of variables that may be considered. This fact would lead to the appearance of a large number of user's profiles. Besides that, the profiles could be so funnelled that the difference between them could not be significant in terms of content preferences

In this manner, it seems desirable, instead of defining profiles based on user characteristics, to define profiles based on macro areas of interest for senior receive information. The interest of

senior viewer in a specific area will be evaluated using a set of related questions. This approach to define user profiles will be validated throughout a set of interviews and focus groups with potential users, researchers and people with experience in the field of gerontechnologies. Using this approach project team has the purpose to obtain user profiles tuned to the preferences and needs of each person.

6. FINAL REMARKS

TV platforms have a great potential to spread information among elderly population due to its wide penetration. Most of the time it is elderly unique means of access to information. This paper characterize the project +TV4E which main goal is to spread information about social public services to elderly throughout an iTV application. Despite the recognized merits of the project main idea, the iTV application that will arise from its development must consider user profiles in order to provide a high level user experience. The target population of the iTV application is the Portuguese senior population. Despite, this paper suggests a set of criteria that allow to filter the users who will help to design and that will be the main users of the application to access social and public information. The criteria defined was: (i) age over 60 years; (ii) know how to read; (iii) have digital literacy; (iv) without cognitive impairment. The defined criteria can be adapted to other projects regarding the specific requirements of each one. However, when it comes to broadcast information content on social and public services to the elderly, it seems important to ensure the fulfilment of the suggested criteria.

As future steps, the authors aim to gather inputs from several stakeholders, such as the elderly population, researchers and experts in the field of iTV and elderly, in order to define the macro areas of interest, and then, define the end-user profiles.

7. ACKNOWLEDGMENTS

The research leading to these work has received funding from Project 3599 – Promover a Produção Científica e Desenvolvimento Tecnológico e a Constituição de Redes Temáticas (3599-PPCDT) and European Commission Funding FEDER (through FCT: Fundação para a Ciência e Tecnologia I.P. under grant agreement no. PTDC/IVC-COM/3206/2014).

8. REFERENCES

[1] United Nations, Department of Economic and Social Affairs, Population Division. 2015. *World Population Ageing 2015*. (ST/ESA/SER.A/390).

[2] He, W., Goodkind, and P. Kowal, P. 2016. *An Aging World: 2015 International Population Reports*. Washington DC.

[3] United Nations. 2011. *Current Status of the Social Situation, Well-Being, Participation in Development and Rights of Older Persons Worldwide.* New York.

[4] World Health Organization. 2016. *Definition of an older or elderly person*. Retrieved September 6, 2016 from http://www.who.int/healthinfo/survey/ageingdefnolder/en/

[5] Instituto Nacional de Estatística. 2002. *O Envelhecimento em Portugal: Situação demográfica e socioeconómica recente das pessoas idosas*.

[6] Ministério da Solidariedade Emprego e Segurança Social. 2014. *Portaria n.º 277/2014 de 26 de dezembro do Ministério da Solidariedade, Emprego e Segurança Social*.

[7] Instituto Nacional de Estatística. 2012. *Censos 2011: Resultados Definitivos – Portugal*. Lisboa, Portugal.

[8] Instituto Nacional de Estatística. 2014. *Projeções de População Residente 2012-2060*.

[9] Schneider, R. H., and Irigaray, T. Q. 2008. O envelhecimento na atualidade: aspectos cronológicos, biológicos, psicológicos e sociais. *Estudos de Psicologia*, 25, 4, pp. 585–593.

[10] Schroots, J. and Birren, J. 1980. A Psychological point of view toward human aging and adaptability. In *Adaptability and Aging, Proceding of 9th International Conference of Social Gerontology*, pp. 43–54.

[11] Martins, R. 2008. Ser idoso hoje. *Rev. Millenium*. 35 (Nov. 2008).

[12] Pereira, C. and Neves, R. 2011. Os idosos e as TIC – competências de comunicação e qualidade de vida. *Rev. Kairós Gerontol.*, 14, 1, pp. 5–26.

[13] Kalache, A. and Gatti, A. 2002. *Active Ageing: a policy framework*.

[14] Eurostat. 2012. *Active ageing and solidarity between generations - A statistical portrait of the European Union 2012*.

[15] Guarda Nacional Republicana. 2016. *Operação 'Censos Sénior 2016' – Resultados*. Retrieved September 6, 2016 from http://www.gnr.pt/comunicado.aspx?linha=62.

[16] Comissão das Comunidades Europeias. 2007. *Envelhecer bem na sociedade da informação*. Bruxelas.

[17] Queirós, A., Cerqueira, M., Martins, A. I., Silva, A. G., Alvarelhão, J., Teixeira, A., Rocha, N. P. 2014. ICF inspired personas to improve development for usability and accessibility in Ambient Assisted Living. *Procedia Comput. Sci.*, 27, pp. 409–418.

[18] Coughlin, J. F. 2007. New Expectations From Older Users: Five Lessons for Product Design and Innovation in an Aging Marketplace. *AgeLab 2007-01, MIT*, pp. 1–7.

[19] Entidade Reguladora para a Comunicação Social. 2016. *As novas dinâmicas do consumo audiovisual em Portugal 2016*. Lisboa.

[20] Nielsen. 2015. *Screen Wars - The battle for eye space in a TV-everywhere world*. Retrieved September 6, 2016 from http://www.nielsen.com/us/en/insights/reports/2015/screen-wars-the-battle-for-eye-space-in-a-tv-everywhere-world.html

[21] Edewor, N., Ijiekhuamhen, O. P., and Emeka-ukwu, U. P. 2016. Elderly people and their information needs. *Library Philosophy and Practice*. 1.

[22] Zou, C., and Zhou, P. 2014. Analyzing information needs of elderly people: A survey in Chinese rural community. *Open J. Soc. Sci.*, 2, pp. 109–115

[23] Martins, R. 2010. Os idosos e as actividades de lazer. *Rev. Millenium*, 38, pp. 243–251.

[24] Marktest Group. 2011. *Portugueses viram cerca de 3h30m de Tv em 2010*. Retrieved October 20, 2016 from http://www.marktest.com/wap/a/n/id~16e0.aspx.

[25] Smart Senior. 2016. *Independent, safe, healthy and mobile*. Retrieved September 23, 2016 from http://www1.smart-senior.de/enEN/index.html.

[26] Boulos, M., Lou, R. C., Anastasiou, A., Nugent, C. D., Alexandersson, J., Zimmermann, G., Cortes, U., Casas, R. 2009. Connectivity for Healthcare and Well-Being Management: Examples from Six European Projects. *Int. J. Environ. Res. Public Health*, 6, 7, pp. 1947–1971.

[27] StoppFalls. 2016. iStoppFalls Risk Assessment Published. Retrieved September 23, 2016 from http://www.istoppfalls.eu/cms/front_content.php?idcat=13&idart=63&lang=1.

[28] Abreu, J. F., Almeida, P., and Silva, T. 2013. iNeighbour TV: A Social TV Application to Promote Wellness of Senior Citizens. In *Information Systems and Technologies for Enhancing Health and Social Care*, 221, IGI, Ed. IGI Global, pp. 1–19.

[29] De Moraes, E. N., de Moraes, F. L., Lima, S. de P. P. 2010. Características biológicas e psicológicas do envelhecimento. *Rev Med Minas Gerais*, 20, 1, pp. 67–73.

[30] Torres, A. 2010. TIC e Idosos: a relação surpresa. In *Actas 3ª Conferência de Ciências e Artes dos Videojogos*, pp. 61–70.

[31] Czaja, S. J. and Lee, C. C. 2007. The impact of aging on access to technology. *Univers. Access Inf. Soc.*, 5, 4, pp. 341–349.

[32] Carreira, R., Crato, J. M., Gonçalves, D., Jorge, J. A. 2004. Evaluating Adaptive User Profiles for News Classification. In *Proceedings of the 9th international conference on Intelligent user interfaces*. pp. 1–7.

[33] Teixeira, A., Queirós, A., Rocha, N. P. 2013. *Laboratório Vivo de Usabilidade - Living Usability Lab*.

[34] European Commission. 2008. Digital Literacy European Commission Working Paper and Recommendations from Digital Literacy High-Level Expert Group.

[35] Guerreiro, M. 2010. Testes de rastreio de defeito cognitivo e demência: uma perspectiva prática. *Rev. Port. Med. Geral e Fam.*, 26, 1, pp. 46–53.

[36] Santana, I., Duro, D., Lemos, R., Costa, V., Pereira, M., Simões, M., Freitas, S., 2016. Mini-Mental State Examination: Avaliação dos Novos Dados Normativos no Rastreio e Diagnóstico do Défice Cognitivo. *Acta Med. Port.*, 29, 4, pp. 240–248.